THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1.   A method of operating a telecommunications network in which the telecommunications network includes plural distinct nodes interconnected by plural distinct spans, each node having a digital cross-connect switch for making and breaking connections between links in adjacent spans forming span paths through the node, the method comprising the steps of:

a) providing a set of successive nodes capable of forming a closed path in the network, with at least one spare link between each pair of adjacent nodes in the closed path;

b) forming a cross-connection at each node in the closed path to connect spare links in each of the adjacent spans lying in the closed path and thus form a span path through each node in the closed path; and

c) upon occurrence of a span failure on any span between any two nodes in the closed path, wherein the span failure is not at a span in the closed path, routing telecommunications traffic along the closed path.

2.   The method of claim 1 in which providing a set of successive nodes capable of forming a closed path comprises:

(a1) selecting an originating node; and

(a2) searching for and identifying a set of intermediate nodes that, together with the originating node, may form a closed path having at least one spare link between each pair of adjacent nodes in the closed path.

3.　　　The method of claim 2 in which searching for a set of intermediate nodes that may form a closed path comprises:

　　　broadcasting statelets from successive nodes in the network along successive spans having at least one spare link in each span at least until a first statelet is broadcast to the originating node, in which the successive nodes are not capable of forming a closed path that does not include the originating node and each statelet is prevented from being broadcast along the span on which the statelet arrived at the intermediate node.

4.　　　The method of claim 3 in which broadcasting statelets comprises:

　　　initiating a broadcast from an originating node by broadcasting an originating statelet; and

　　　receiving incoming statelets at intermediate nodes, and broadcasting at least one statelet received by each intermediate node to one or more nodes adjacent to the intermediate node and connected to the intermediate node by at least one spare link.

5.　　　The method of claim 4 in which only one statelet derived from the same originating statelet is broadcast, at any intermediate node, on any one span.

6.　　　The method of claim 5 in which each statelet is broadcast to the maximum extent possible at each successive node.

7.　　　The method of claim 5 in which a statelet broadcast through the network is modified at each intermediate node to update a route field in the statelet

that records the successive nodes by which the statelet has been broadcast.

8. The method of claim 7 in which incoming statelets at an intermediate node are broadcast preferentially according to an ordering of the incoming statelets.

9. The method of claim 7 in which a statelet broadcast through the network is modified at each intermediate node to update a numPaths field in the statelet that records the number of paths available for restoration of telecommunications traffic along the successive nodes by which the statelet has been broadcast.

10. The method of claim 9 in which a statelet broadcast through the network is modified at each intermediate node to update a hop count field in the statelet that records the number of spans traversed by the statelet.

11. The method of claim 10 in which incoming statelets at an intermediate node are broadcast preferentially according to an ordering of the incoming statelets based upon relative values of the numPaths and hop count fields of the incoming statelets.

12. The method of claim 7 in which a closed path is formed by making cross-connections between successive spans in one of several routes followed by incoming statelets received by an originating node.

13. The method of claim 12 in which the one of several routes is selected according to an ordering of fields in the incoming statelets.

14.   The method of claim 13 in which the ordering is based upon a relationship between the number of paths available for restoration of telecommunications traffic along the successive nodes by which each incoming statelet has been broadcast and the number of spans traversed by the respective incoming statelets.

15.   The method of claim 13 in which routes followed by incoming statelets are evaluated for a pre-determined period.

16.   The method of claim 5 in which a closed path is formed by making cross-connections between successive spans in one of several routes followed by incoming statelets received by an originating node.

17.   The method of claim 16 in which the one of several routes is selected according to an ordering of fields in the incoming statelets.

18.   The method of claim 17 in which the ordering is based upon a relationship between the number of paths available for restoration of telecommunications traffic along the successive nodes by which each incoming statelet has been broadcast and the number of spans traversed by the respective incoming statelets.

19.   The method of claim 17 in which routes followed by incoming statelets are evaluated for a pre-determined period.

20.   The method of claim 2 further comprising repeating steps a1 and a2 for each of several originating nodes in the network.

21.   A method of operating a telecommunications network in which the telecommunications network includes plural distinct nodes interconnected by plural distinct spans, each node having a digital cross-connect switch for making and breaking connections between links in adjacent spans forming span paths through the node, the method comprising the steps of:

(a1) selecting an originating node;

(a2) initiating an automatic search from the originating node to identify a set of successive intermediate nodes that, together with the originating node, may form a closed path having at least one spare link between each pair of adjacent nodes in the closed path; and

b) forming a cross-connection at each node in the closed path to connect spare links in each of the adjacent spans lying in the closed path and thus form a span path through each node in the closed path;

22.   The method of claim 21 in which searching for a set of intermediate nodes that may form a closed path comprises:

broadcasting statelets from successive nodes in the network along successive spans having at least one spare link in each span at least until a first statelet is broadcast to the originating node, in which the successive nodes are not capable of forming a closed path that does not include the originating node and each statelet is prevented from being broadcast along the span on which the statelet arrived at the intermediate node.

23.   The method of claim 22 in which broadcasting statelets comprises:

initiating a broadcast from an originating node by broadcasting an originating statelet; and

receiving incoming statelets at intermediate nodes, and broadcasting at least one statelet received by each intermediate node to one or more nodes adjacent to the intermediate node and connected to the intermediate node by

5   at least one spare link.

24.   The method of claim 23 in which only one statelet derived from the same originating statelet is broadcast, at any intermediate node, on any one span.

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25.   The method of claim 24 in which each statelet is broadcast to the maximum extent possible at each successive node.

15   26.   The method of claim 24 in which a statelet broadcast through the network is modified at each intermediate node to update a route field in the statelet that records the successive nodes by which the statelet has been broadcast.

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27.   The method of claim 26 in which incoming statelets at an intermediate node are broadcast preferentially according to an ordering of the incoming statelets.

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28.   The method of claim 26 in which a statelet broadcast through the network is modified at each intermediate node to update a numPaths field in the statelet that records the number of paths available for

30   restoration of telecommunications traffic along the successive nodes by which the statelet has been broadcast.

29.   The method of claim 28 in which a statelet broadcast through the network is modified at each

intermediate node to update a hop count field in the statelet that records the number of spans traversed by the statelet.

5   30.   The method of claim 29 in which incoming statelets at an intermediate node are broadcast preferentially according to an ordering of the incoming statelets based upon relative values of the numPaths and hop count fields of the incoming statelets.

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31.   The method of claim 26 in which a closed path is formed by making cross-connections between successive spans in one of several routes followed by incoming statelets received by an originating node.

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32.   The method of claim 31 in which the one of several routes is selected according to an ordering of fields in the incoming statelets.

20   33.   The method of claim 32 in which the ordering is based upon a relationship between the number of paths available for restoration of telecommunications traffic along the successive nodes by which each incoming statelet has been broadcast and the number of spans traversed by the 25   respective incoming statelets.

34.   The method of claim 32 in which routes followed by incoming statelets are evaluated for a pre-determined period.

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35.   The method of claim 24 in which a closed path is formed by making cross-connections between successive spans in one of several routes followed by incoming statelets received by an originating node.

36.   The method of claim 35 in which the one of several routes is selected according to an ordering of fields in the incoming statelets.

37.   The method of claim 36 in which the ordering is based upon a relationship between the number of paths available for restoration of telecommunications traffic along the successive nodes by which each incoming statelet has been broadcast and the number of spans traversed by the respective incoming statelets.

38.   The method of claim 36 in which routes followed by incoming statelets are evaluated for a pre-determined period.

39.   The method of claim 21 further comprising repeating steps a1, a2 and b for each of several originating nodes in the network.

40.   The method of claim 21 further comprising periodically repeating steps a2 and b at a node.

41.   The method of claim 40 in which the network has a configuration of working links, and repetition of steps a2 and b at a node is carried out after a change of the configuration of working links in the network.

42.   The method of claim 41 in which the repetition of steps a2 and b at a node is carried out for each of several nodes in the network.

43.   The method of claim 22 further comprising periodically repeating steps a2 and b at a node.

44.   The method of claim 43 in which the network has a configuration of working links, and repetition of steps a2 and b at a node is carried out after a change of the configuration of working links in the network.

45.   The method of claim 44 in which the repetition of steps a2 and b at a node is carried out for each of several nodes in the network.

46.   A method of establishing a connected telecommunications route through a telecommunications network, in which the telecommunications network includes plural distinct nodes interconnected by plural distinct spans, each node having a digital cross-connect switch for making and breaking connections between links in adjacent spans forming span paths through the node, the method comprising the steps of:

broadcasting a statelet from an originating node along successive spare links to successive intermediate nodes in the network commencing with at least one node adjacent to the originating node and connected to the originating node with a spare link, wherein the statelet has a route field containing information on the route of successive intermediate nodes by which the statelet has been broadcast;

updating the route field at each successive intermediate node;

receiving the statelet at an end node; and

constructing a connected path of cross-connected spare links along the route defined by the route field of the statelet received at the end node.

47.   The method of claim 46 in which several statelets are received at the end node, each statelet having a

distinct route associated with the statelet, and the connected path is formed along only a selected one of the distinct routes.

5   48.   The method of claim 47 in which the selected one of the distinct routes is selected according to an ordering of the distinct routes.

49.   The method of claim 48 in which the end node is
10   the originating node.

50.   The method of claim 47 in which the end node is not the originating node.

15   51.   The method of claim 47 further comprising:
          assigning a unique index character to each statelet broadcast along a spare link from the originating node; and
          broadcasting only one statelet having a specific
20   index character along any one span.

52.   The method of claim 47 further comprising:
          preferentially broadcasting statelets received by an intermediate node according to an ordering of the
25   statelets.